

Agenda

- Informix Backup Options
- Logical Log Backups
- Informix Server Backups
- Testing Backups
- Informix High Availability Options
- Setting up Informix HDR

Informix Backup Options

Informix Backup Options

- **Database Backup and Restore**
 - dbexport and dbimport
 - onunload and onload (binary)
- **Table Backup and Restore**
 - SQL unload and load
 - onunload and onload (binary)
 - High Performance Loader (HPL) or External Tables
 - archecker for table level restore
- **Informix Server Backup and Restore**
 - ontape
 - onbar

SQL Unload and Load

- The Unload and Load Statement are SQL Extensions to Informix in Dbaccess and ISQL used to unload/load a table or part of a table
- Creates ASCII or text file of the data in a table with a field delimiter
- Portable to other systems, even non-Informix databases
- Can be used with select statements to unload some fields (list fields to unload) or some rows (add a where clause)
- Blob data will be unloaded as hexadecimal data

Syntax to unload a table to a file:

unload to *filename* select * from *tablename*;

Syntax to load a table from a file:

load from *filename* insert into *tablename*;

Dbexport and Dbimport

- To unload a whole database
- Creates ASCII files with all the data and the schema
- Portable to other systems
- Locks the database during an export
- Database may be exported to a directory or tape

Onload and Onunload

- To create a binary unload of a whole database or one table
- Can only be loaded on the same machine type and Informix version
- Loads and unloads disk pages, does not compress rows
- Locks database/table during unload
- May be unloaded to tape or file

Onbar and Ontape

On-line backup of whole server, selected dbspaces, and logical logs. Use this tool to backup your entire server on a regular basis. Creates a binary unload of the server. Can only be restored on a system with exactly the same operating system version, configuration, dbspaces, ONCONFIG, and version of Informix.

Loads and unloads disk pages, does not compress rows. Does NOT lock database or tables during backup. Users can continue to access the system.

Supports archive levels:

- 0 - full system
- 1 - only disk pages changed since last 0
- 2 - disk pages changes since last 1

Onbar and Ontape

Task	Onbar	Ontape
Back up all database server data?	yes	yes
Back up logical-log files?	yes	yes
Perform continuous logical-log backups?	yes	yes
Perform continuous logical-log restore?	yes	yes
Back up while the database server is online?	yes	yes
Back up while the database server is in quiescent mode?	yes	yes
Restore all database server data?	yes	yes
Restore selected storage spaces?	yes	yes
Back up and restore storage spaces serially?	yes	yes
Perform cold restores with the database server offline?	yes	yes
Initialize high availability data replication?	yes	yes
Perform separate physical and logical restores?	yes	yes
Rename a chunk path name or device during a cold restore?	yes	yes
Perform imported restores?	yes	yes
Perform external backups and restores?	yes	yes
Transform data with external programs?	yes	yes
Encrypt or decrypt a storage space during a restore?	yes	yes

Onbar and Ontape Differences

Task	Onbar	Ontape
Use a storage manager to track backups and storage media?	yes	no
Back up selected storage spaces?	yes	no
Restore data to a specific point in time?	yes	no
Back up and restore different storage spaces in parallel?	yes	no
Use multiple tape drives concurrently for backups and restores?	yes	no
Restart a restore?	yes	no
Monitor performance?	yes	no
Change logging mode for databases?	no	yes
Back up to or restore from cloud storage?	no	yes

Source: IBM Knowledge Center

Comparison of the onbar and ontape utilities:

https://www.ibm.com/support/knowledgecenter/en/SSGU8G_14.1.0/com.ibm.bar.doc/ids_bar_177.htm

Onbar and Ontape Choice

- Use Onbar
 - Have a very large Server and need parallel backups to reduce backup time
 - Use a storage manager with multiple tape drives concurrently for backups and restores
 - Require point in time restore capabilities
- Use Ontape
 - Simple and easy to setup
 - No parallel capabilities
 - Supports remote backup to other servers and cloud

Do not Mix using Onbar and Ontape

Informix Server Backups

Important - Saving Configuration Information

The Informix Server system configuration must be documented so it can be rebuilt from scratch. The DBA must have copies of:

- ONCONFIG file: (\$INFORMIXDIR/etc/\$ONCONFIG)
- SQLHOSTS file: (\$INFORMIXDIR/etc/sqlhosts or \$INFORMIXSQLHOSTS)
- TCP/IP Services and hosts files (/etc/services, /etc/hosts.equiv and /etc/hosts)
- Disk space layout (onstat -d)
- Disk partition layout or logical volume layout
- Links between dbspaces and disk partitions
- Databases schema(s)
- When using Onbar you will need the Emergency Boot file (ixbar)

Informix Server Backup Levels

- 0 – Full Server Backup
- 1 – Backup all pages changed since the last level 0
- 2 – Backup all pages changed since the last level 1

Informix Server Backups

- Recommend full daily level 0 archives whenever possible
- Requires naming and labeling all files or tapes and coordinating with Logical Log backups

Backing up the Informix Server

ONCONFIG entries define the Backup Device

TAPEDEV	/dev/tapedev	# Tape device path
TAPEBLK	16	# Tape block size (Kbytes)
TAPESIZE	10240	# Maximum amount of data to put on tape (Kbytes)

TAPEDEV Options:

- /dev/null – performing a backup will reset internal parameters without performing an actual backup
- /dev/rmt0 – Full Backup to tape
- /backup/\$INFORMIXSERVER/archive – backup to a directory
- /backup/\$INFORMIXSERVER/filename.ontape – backup to a file

Backing up the Server to Disk

- The entire backup must fit on one file system
- Must then be backed up to tape using Storage Manager or Unix tape utilities (tar,cpio,dump)
- Backing up to a Directory on a File System

Figure – Informix backup to disk

```
informix@train14:~/newserver newserver > ontape -s
Please enter the level of archive to be performed (0, 1, or 2) 0

Please mount tape 1 on /home/informix/backups/newserver/newserver.ontape and press Return to continue ...
100 percent done.
Read/Write End Of Medium enabled: blocks = 651

Please label this tape as number 1 in the arc tape sequence.
This tape contains the following logical logs:

3

Program over.
informix@train14:~/newserver newserver > █
```

Restoring Informix Server

- Restore Configuration Files
- Re-Create dbspace links and devices
- Ontape Restore
- Restore and roll forward Logical Logs

Restore the Configuration Files

- Restore \$INFORMIXDIR
- ONCONFIG File
(\$INFORMIXDIR/etc/\$ONCONFIG)
- Tape device configuration
- SQLHOSTS File
(\$INFORMIXDIR/etc/sqlhosts)
- TCP/IP services and hosts files (/etc/services, /etc/hosts.equiv and /etc/hosts)

Re-Create Chunk Devices Links

- Re-create original disk space (onstat -d)
- Re-create original disk partition layout or logical volume layout
- Re-create links between dbspaces and disk partitions

Ontape Restore

- Informix Server must be off-line (onmode -ky)
- Restore command - ontape -r

Figure – Informix Restore from disk

```
informix@train14:~/newserver newserver > ontape -r

Please mount tape 1 on /home/informix/backups/newserver/newserver.ontape and press Return to continue ...

Archive Tape Information

Tape type:          Archive Backup Tape
Online version:     IBM Informix Dynamic Server Version 12.10.FC8
Archive date:       Wed Apr 19 14:27:21 2017
User id:            informix
Terminal id:        /dev/pts/0
Archive level:      0
Tape device:        /home/informix/backups/newserver/newserver.ontape
Tape blocksize (in k): 32
Tape size (in k):   0
Tape number in series: 1

Spaces to restore: 1 [rootdbs
                    ]
2 [logdbs
   ]
3 [datadbs
   ]

Archive Information

IBM Informix Dynamic Server Copyright 2001, 2016 IBM Corporation
Initialization Time      04/19/2017 14:23:33
System Page Size        2048
Version                 29
Index Page Logging      OFF
Archive CheckPoint Time 04/19/2017 14:27:20

Dbspaces
number  flags    fchunk  nchunks  flags  owner      name
1       20001    1        1        N A    informix   rootdbs
2       20001    2        1        N A    informix   logdbs
3       20001    3        1        N A    informix   datadbs
4       2001    4        1        N T A    informix   tmpdbs

Chunks
chk/dbs  offset  size    free    bpages  flags  pathname
1 1 0 200000 135065 PO---- /informixchunks/newserver/rootdbs
2 2 0 100000 9947 PO---- /informixchunks/newserver/logdbs
3 3 0 100000 9947 PO---- /informixchunks/newserver/datadbs
4 4 0 100000 9947 PO---- /informixchunks/newserver/tmpdbs

Continue restore? (y/n) ☐
```

Figure – Informix Restore from disk

```
Continue restore? (y/n)y
Do you want to back up the logs? (y/n)n
Read/Write End Of Medium enabled: blocks = 652
Restore a level 1 archive (y/n) n
Do you want to restore log tapes? (y/n)n
/opt/informix12.10.FC8/bin/onmode -sy

Program over.
informix@train14:~/newserver newserver > 
```

Key Prompt? Why is this important?

Ontape Restore (continued)

Restore prompts:

- 1) If Logical Logs are available, ontape will prompt you to save them so that they can be used to roll forward after the restore.
 - 2) After the restore, ontape will prompt for a level 1 or 2 archive to restore over the level 0 archive.
 - 3) After restoring all archives, ontape will prompt for any logical log tapes that need to be restored.
- If the restore is successful, Informix Server will go to quiescent mode.

Ontape Backup to STDIO

- Backup to standard output or a pipe to another program

- Used to compress backup files

- Used to encrypt backup files

ontape -s -L 0 -t STDIO > newbackup.ontape

ontape -r -t STDIO < newbackup.ontape

ontape -s -L 0 -t STDIO | gzip > newfile.gzip

External Backups

- External Backups are when you use another Non-Informix program to backup your data.
- Examples
 - VM Snapshots
 - SAN Disk Cloning
 - Unix dd or cpio commands

Important to make sure all data structures in memory are Synced to disk

External Backups Steps

Important to make sure all data structures in memory are Synced to disk

1. Block the Informix Server so the data structures on disk are not changing
 - Onmode –c block
2. Perform your backup using the other program
3. Unblock the Informix Server
 - Onmode –c unblock

Testing Informix Backups

ARChecker

- Validate a backup tape from Ontape or Onbar
- Can run on a different machine
- Allows extract of a specific table from the archive

Archecker Configuration File

```
#*****
#   Title:      ac_config.std
#   Description:
#               Default ac_config.std for archecker archive utility
#
#*****
AC_MSGPATH      /tmp/ac_msg.log      # archecker message log
AC_STORAGE      /tmp                 # Directory used for temp storage
AC_VERBOSE      1                    # 1 verbose messages 0 terse messages
AC_TAPEDEV      /dev/rmt/0           # Must match TAPEDEV in onconfig
AC_TAPEBLOCK    64                   # Must match TAPEBLK in onconfig
#*****
```

Archecker Configuration

- **AC_STORAGE** - This is the name of the directory where archecker temporary files are kept. The amount of space required will be determined by the number of chunks and the number of tables. You will need a lot of free space in this filesystem. To estimate, I recommend having 1MB of free space for every 2GB of dbspace on your system. If this directory is not set, it will default to your current directory.
- **AC_MSGPATH** - Location and pathname of archecker's message log. All error and status messages will be placed in this file.
- **AC_TAPEDEV** - The name of the tape device to be used for reading and checking the archive.
- **AC_TAPEBLOCK** - The size of the tape block in KB. It must match the blocksize from the ONCONFIG file used for the archive. If it does not match, you will get an error that will indicate the correct blocksize to use.

Archecker Command Options

archecker -b -D -d -R -F -v -s -t -T -V

- b Direct XBSA access
- D Delete old files from previous run and exit
- d Delete old files from previous run
- F Retrieve list of pages off the archive
- P Read Performance info only
- R Restart the checking
- s Print status message to the screen
- t Read the tape directly
- T Restart at a specific tape
- v Verbose mode, print dots to the screen for every 25MB of data
- V Display version

Using Archecker

- Command to test backups on the same machine that a backup was made on:

`archecker -tdsv`

Using Archecker

```
informix@train14:~/newserver newserver > archecker -tdsv
IBM Informix Dynamic Server Version 12.10.FC8
Program Name: archecker
Version: 8.0
Released: 2016-11-11 15:42:57
CSDK: IBM Informix CSDK Version 4.10
ESQL: IBM Informix-ESQL Version 4.10.FC8
Compiled: 11/11/16 15:43 on Linux 2.6.18-128.el5 #1 SMP Wed Dec 17 11:41:38 EST 2008

AC_STORAGE /tmp
AC_MSGPATH /tmp/ac_msg.log
AC_VERBOSE on
AC_TAPEDEV /home/informix/backups/newserver/newserver.ontape
AC_TAPEBLOCK 32 KB
AC_LTAPEDEV /home/informix/backups/newserver/logs/
AC_LTAPEBLOCK 32 KB
AC_TIMEOUT 300
AC_SESSION

Please put in Phys Tape 1.
Type <return> or 0 to end:

Tape type: Archive Backup Tape
Online version: IBM Informix Dynamic Server Version 12.10.FC8
Archive date: Wed Apr 19 15:37:10 2017
Archive level: 0
Tape blocksize: 32768
Tape size: 0
Tape number in series: 1

Scan PASSED
Control page checks PASSED
Reserve page validation PASSED
Checking rootdbs:TBLSpace

Checking sysmaster:sysdatabases
Checking system:syslicenseinfo
```

Using Archecker

```
Checking sysadmin:mon_vps
Checking sysadmin:mon_checkpoint
Checking sysadmin:idx_mon_ckpt_1
Checking sysadmin:mon_page_usage
Checking sysadmin:mon_page_usage_ix1
Checking sysadmin:mon_page_usage_ix2
Checking logdbs:TBLSpace
Checking datadbs:TBLSpace

Table checks PASSED
Tables/Fragments validated:      416
Archive Validation PASSED.
informix@train14:~/newserver newserver > █
```

Informix High Availability Options

Types of Informix Data Replication

- High Availability Data Replication – HDR and RSS
- Enterprise Replication – ER or CDR
- Shared Disk Replication Cluster – SDS or MACH
- Continuous Log Restore
- Flexible Grid – Cluster of Servers

Replication for Disaster Recovery

- Protect data from catastrophic loss of physical resources
- Ensure user experience under extreme conditions
- Ensure organizational survival

Replication for Load Balancing

- Maintain a consistent level of performance for all concurrent users
- Maximize throughput
- Minimize response time
- Increase reliability
- Prevent excess stress and premature aging of equipment
- Maintain confidence in all systems

Replication for Service Level Scaling

- Service increasing permanent load over time
- React quickly to short term and periodic load spikes
- Maintain a consistent user experience under all load conditions
- Share physical resources with other requirements during minimal load periods

Replication for High Availability

- Support Service Level Agreements
- Isolate users' experience from physical system problems
- Minimize or eliminate downtime
 - Unscheduled
 - Scheduled

Replication for Geographic Data Distribution

- Provide local access to centrally maintained data
- Improve user experience

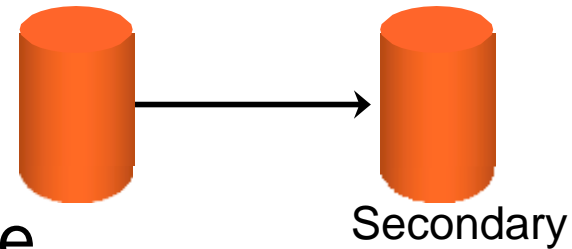
Replication for Maintaining a Central Data Repository

- Centralized for safety
- Centralized application access
- Centralized for data consolidation and reporting

Why Replicate?

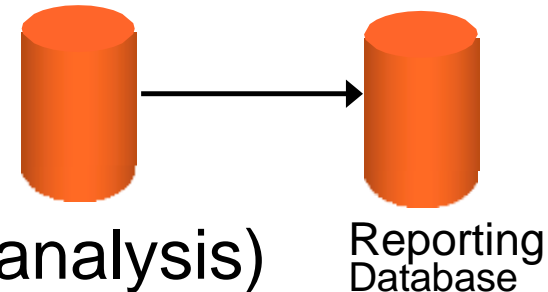
High Availability

Provide a hot backup to avoid downtime due to system failure



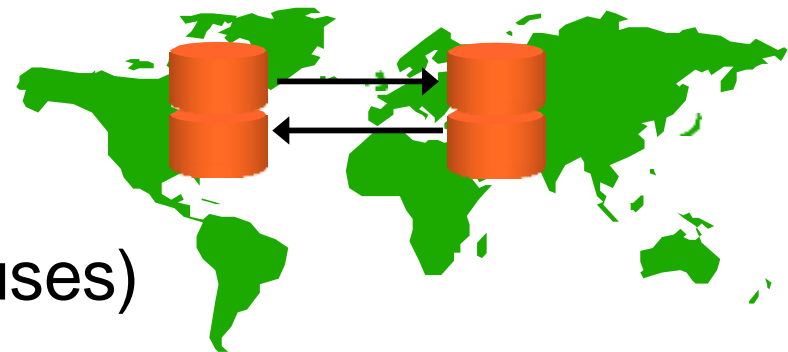
Capacity Relief

Offload some work onto secondary systems (reporting/analysis)



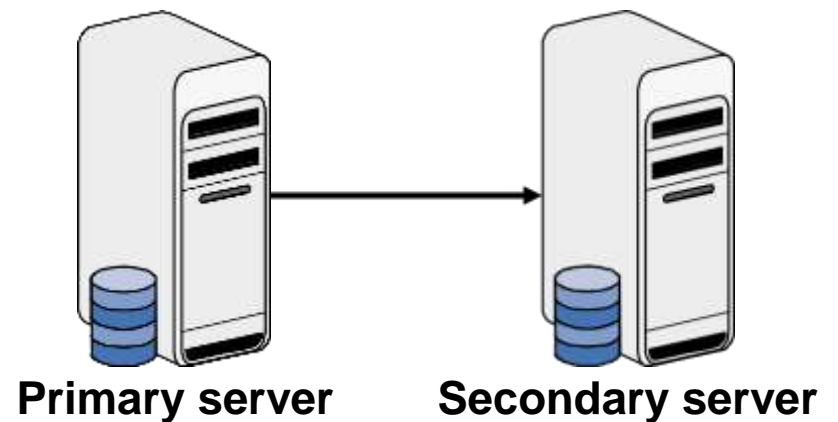
Workload Partitioning

Different data 'owned' in different locations (warehouses)



HDR Replication

- Uses:
 - High availability: takeover from primary
 - Capacity relief: distribute workload
- Secondary available for Read-only queries
- Simple to administer
- Integrated
 - Compatible with all other Informix availability solutions
 - Any ER node can also be an HDR pair



Strengths of HDR

- Easy setup
 - Just backup the primary and restore on the secondary
 - No significant configuration required
- Secondary can be used for dirty reads
- Provides failover to secondary
 - Automatic failover when DRAUTO is set
- Stable code
 - Has been part of the product since version 7
- Integrates easily with ER



Recent HDR Features

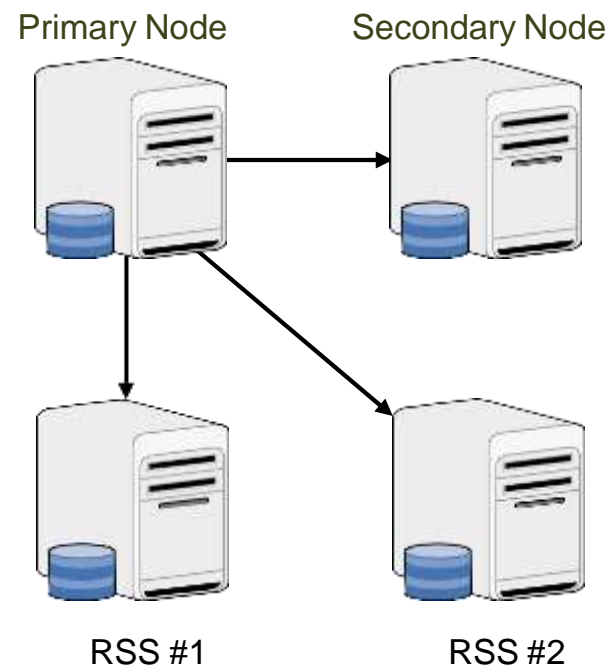
- DRIDXAUTO
 - Specifies if the primary will automatically resend indexes if the secondary detects corruption of the index
- ER/HDR
 - Support of ER within the HDR environment
- Support of logged extended/user defined types
 - Time Series, Smart Blobs, Logged UDTs
- Support for HDR groups
 - Supports connection failover
- Ontape to STDOUT
 - Allows a secondary to be restored from primary without doing a backup to media



Remote Standalone Secondary (RSS)

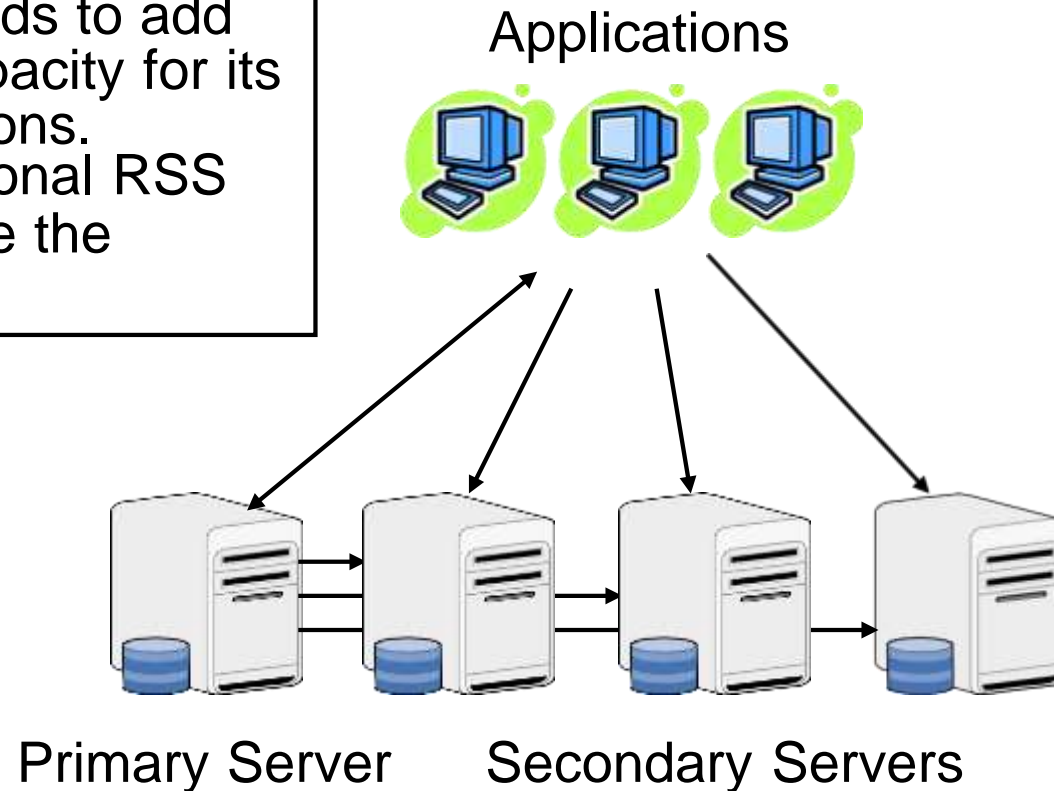
- Next evolutionary step for HDR
 - New type of secondary – RSS nodes
 - Can have 0 to N RSS nodes
 - Can coexist with HDR secondary
- Uses
 - Reporting
 - Web Applications
 - Additional backup in case primary fails
- Similarities with HDR secondary node
 - Receive logs from Primary
 - Has its own set of disks to manage
 - Primary performance does not affect RSS
 - RSS performance does not affect primary
- Differences with HDR secondary node
 - Can only be promoted to HDR secondary, not primary
 - Can only be updated asynchronously
 - Only manual failover supported

Replication to Multiple Remote Secondary Nodes



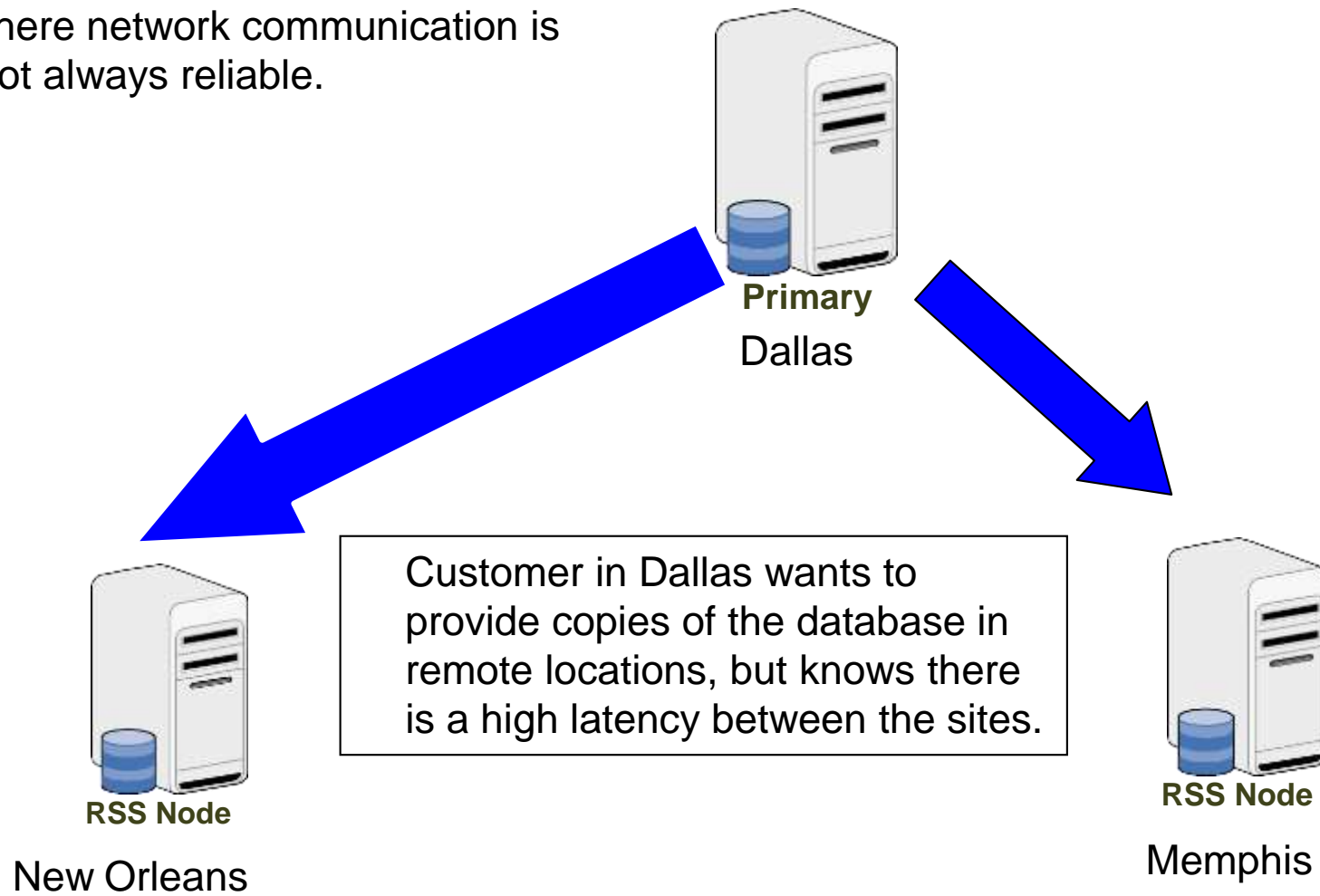
Usage of RSS: Additional Capacity

Customer needs to add additional capacity for its web applications. Adding additional RSS nodes may be the answer.



Usage of RSS – Availability with Poor Network Latency

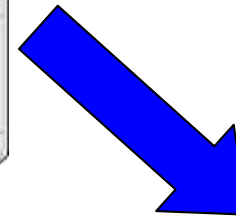
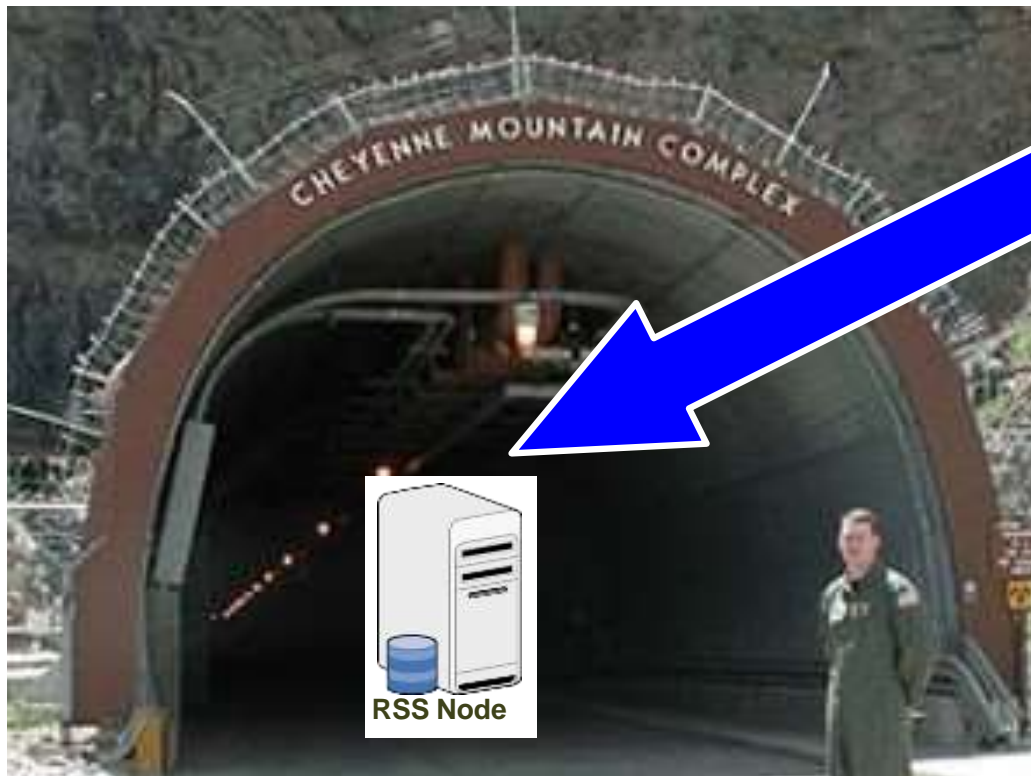
RSS uses a fully duplexed communication protocol. This allows RSS to be used in places where network communication is slow or not always reliable.



Usage of RSS – Bunker Backup

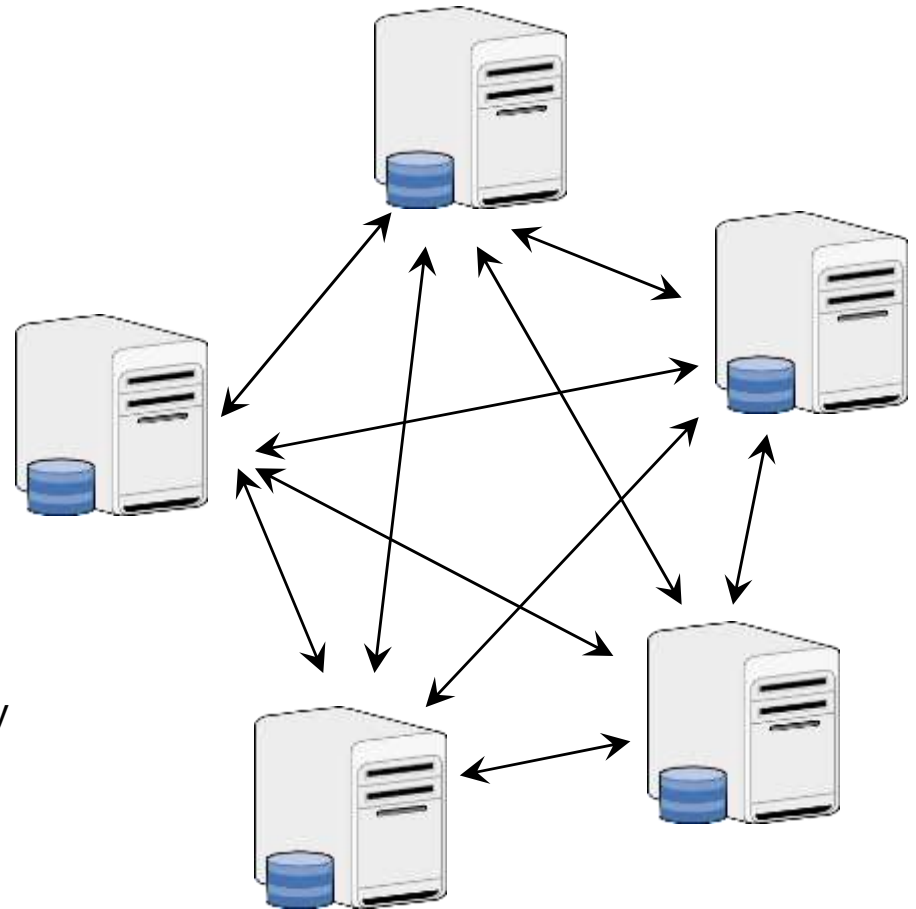
Customer currently has their primary and secondary in the same location and is worried about losing them in a disaster. They would like to have an additional backup of their system available in a remote location for disaster recovery.

Using HDR to provide High Availability is a proven choice. Additional disaster availability is provided by using RSS to replicate to a secure 'bunker'.



Enterprise Replication

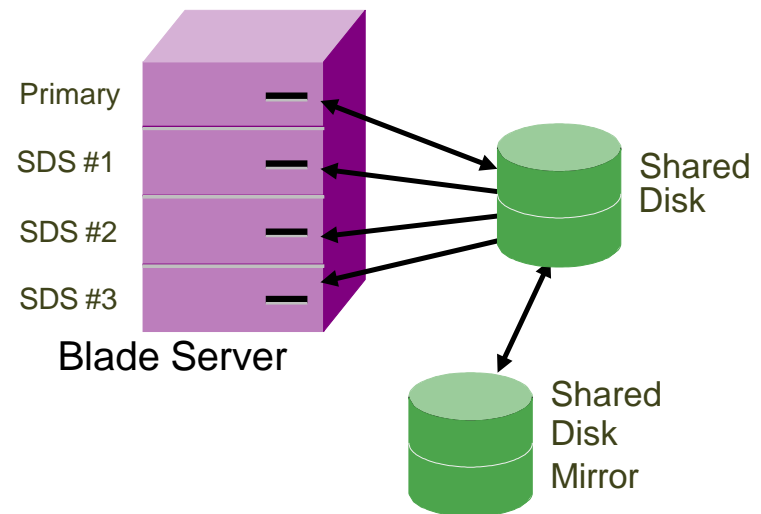
- Uses
 - Workload partitioning
 - Capacity relief
- Flexible and Scalable
 - Subset of data
 - Only RDBMS with this feature
- Supports update anywhere
 - Very low latency
 - Synchronize local with global data
- Integrated
 - Compatible with all other Informix availability solutions
 - Secure data communications



Shared Disk Secondary (SDS)

- Next evolutionary step
 - SDS nodes share disks with the primary
 - Can have 0 to N SDS nodes
- Uses
 - Adjust capacity online as demand changes
 - Does not duplicate disk space
- Features
 - Does not require any specialized hardware
 - Simple to setup
 - Can coexist with ER
 - Can coexist with HDR and RSS secondary nodes
- Similarities with HDR secondary node
 - Dirty reads allowed on SDS nodes
 - The primary can failover to any SDS node
- Differences with HDR secondary node
 - Only manual failover of primary supported

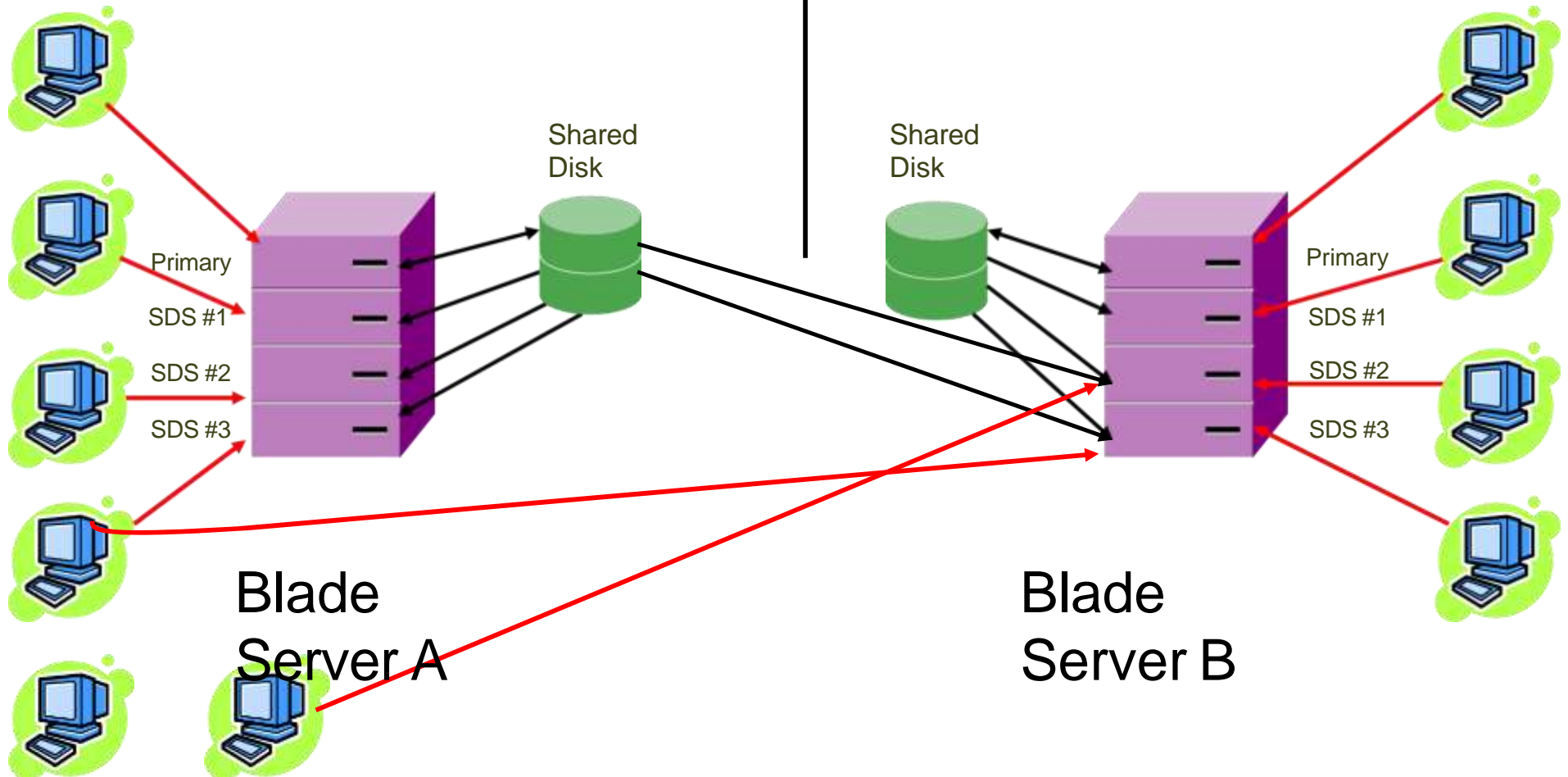
HDR with Multiple Shared Disk Secondary Nodes



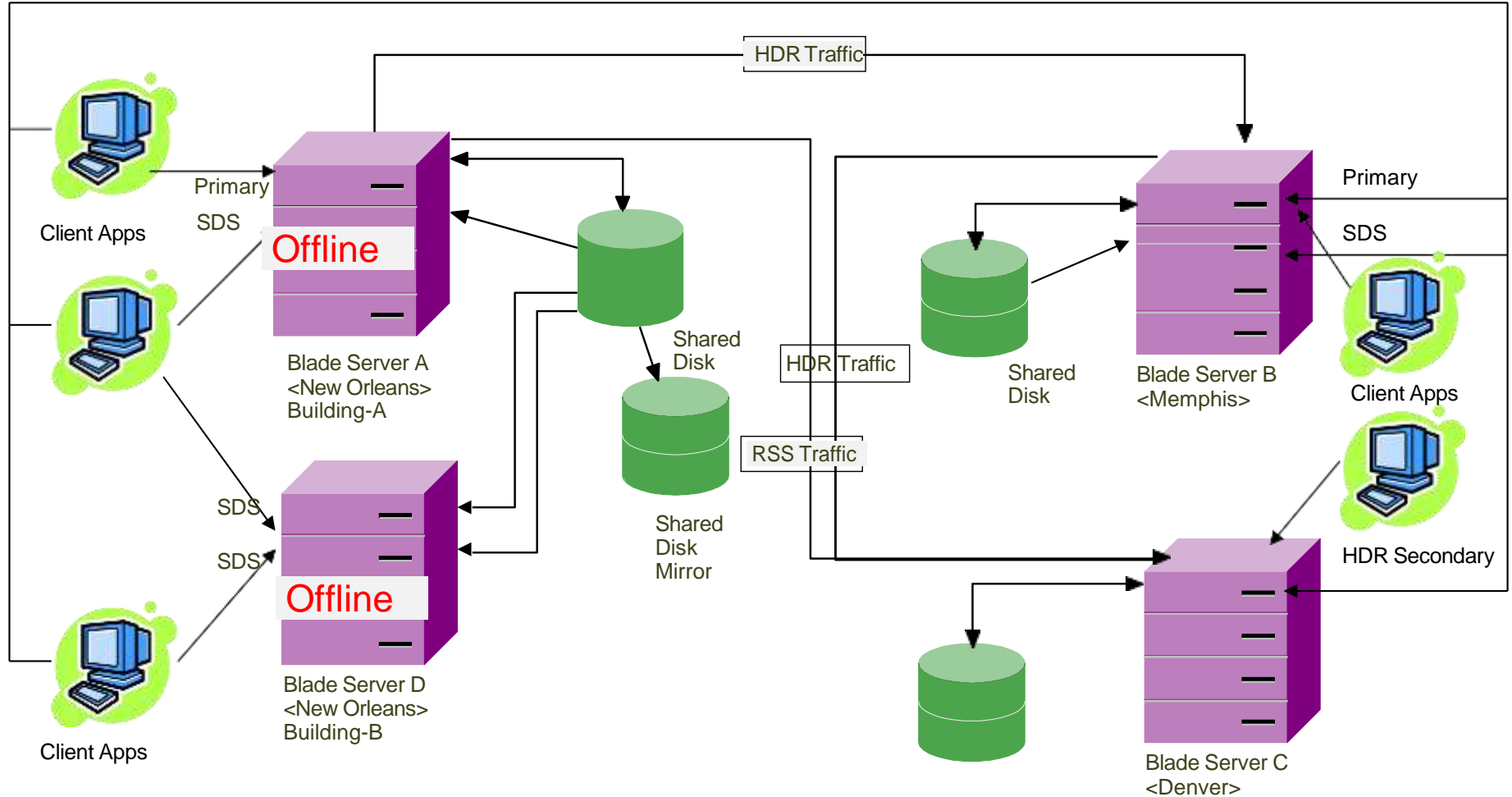
SDS Usage: Capacity as Needed

Web Applications

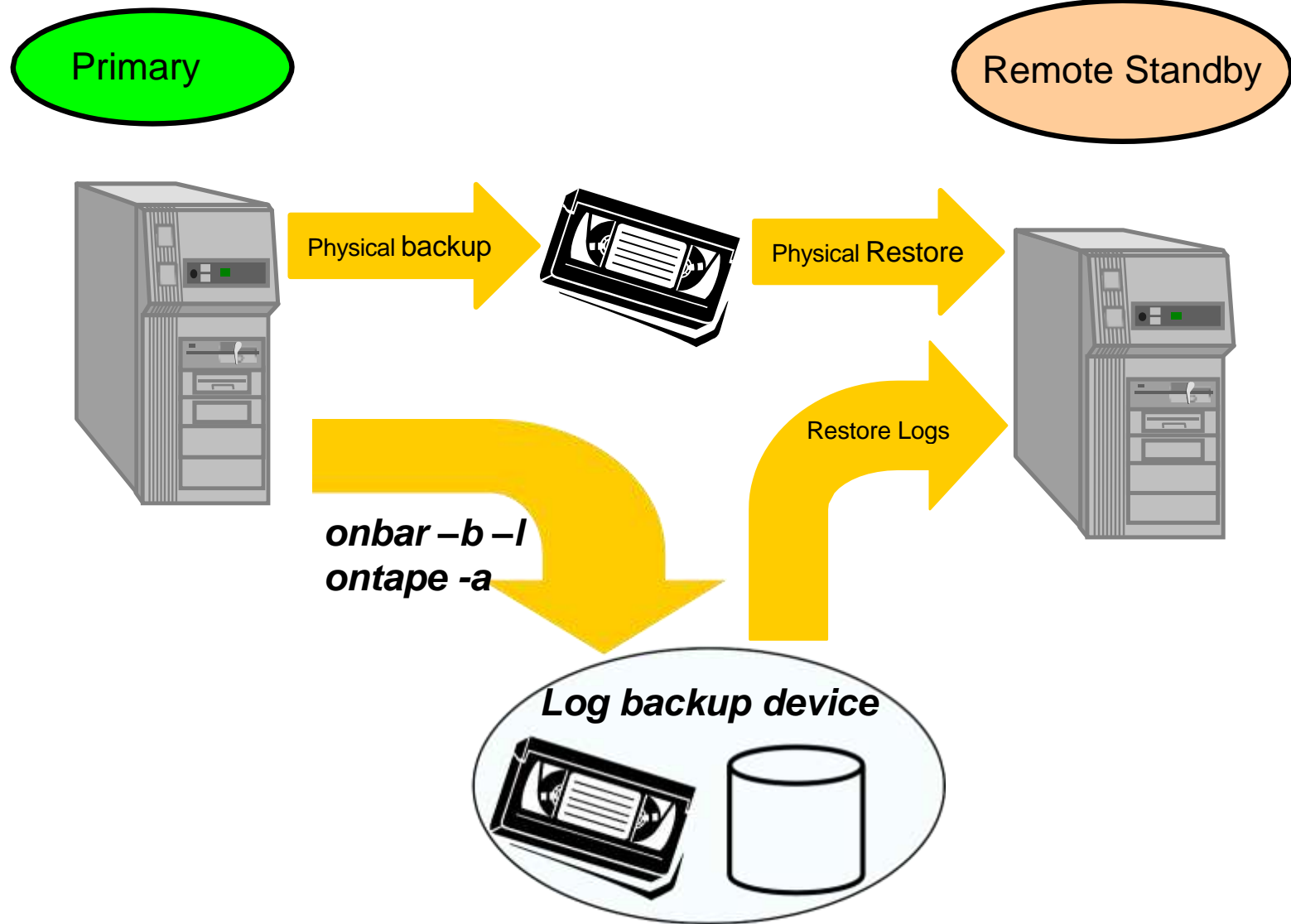
Analytic Applications



Replication – The Complete Picture



Continuous Log Restore



Using Continuous Log Restore Option

- Logical log backups made from an Informix instance are continuously restored on a second machine
- Using continuous log restore does not effect the primary server
- Can co-exist with HDR/ER for disaster recovery (use HDR for HA and continuous log restore for disaster recovery)
- Sending logs can be automated via ALARMPROGRAM in onconfig

Setting Up Informix (HDR) High Availability Replication

Informix HDR Checklist

	Primary	Secondary
INFORMIXSERVER	newserver	newserverS
DBSERVERALIAS	newservertcp	newserverStcp
Hostname	train14	train11
Informix Port	1527	1527

Informix HDR Checklist

Task	Primary	Secondary
1	Setup the environment	Setup the environment
2	Setup Trusted Connections in ONCONFIG REMOTE_SERVER_CFG filename Or use .rhosts	Setup Trusted Connections in ONCONFIG REMOTE_SERVER_CFG filename Or use .rhosts
3	Add to ONCONFIG LOG_INDEX_BUILDS 1	
4	Add entries to sqlhosts file for secondary	Add entries to sqlhosts file for primary and secondary
5	Do a backup ontape -s -L 0	
6	Start Primary Server: onmode -d primary newserverStcp	
7		Copy onconfig from primary and make following changes: 1.TAPEDEV 2.DBSERVERNAME change to newserverS 3.DBSERVERALIASES change to newserverStcp
8		Copy the ontape backup from the primary and restore backup from primary ontape -p
9		onstat - make sure it's in fast recovery
10		Start the Secondary Server: onmode -d secondary newservertcp
11		onstat - m -r wait until fast recovery goes away
12	Test connection	Test connection

Switching Primary and Secondary Servers

Steps	Old Primary – New Secondary	Old Secondary – New Primary
1	Make sure the old primary is shutdown: <code>onmode -yuk</code>	
2		Change Old Secondary to standard: <code>onmode -d standard</code>
3		Change Old Secondary to primary: <code>onmode -d primary tiger4tcp</code>
4	Start the Old Primary Server in Physical recovery mode: <code>oninit -PHY</code>	
5	Start as New Secondary: <code>onmode -d secondary tiger4Stcp</code>	